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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/052,688 03/31/98 CLEVINGER

L 98P7476US

EXAMINER

MMC2/1121

SIEMENS CORPORATION
INTELLECTUAL PROPERTY DEPARTMENT
186 WOOD AVENUE SOUTH
ISELIN NJ 08830

PERALTA, G

ART UNIT

PAPER NUMBER

2814

DATE MAILED:

11/21/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/052,688

Applicant(s)

CLEVENGER ET AL.

Examiner

Ginette Peralta

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 June 2000.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 7-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5 and 7-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

- 15) ☐ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 18) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
2. Claims 2-5 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
3. Claims 2-5 recite the limitation "the conductive material of the liner" in line 1 of each claim. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.
5. Claims 1-5 and 7-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sumi et al.(U.S. Pat. 5,397,744).

Sumi teaches an integrated circuit comprising a dielectric layer 20 formed over a substrate; a damascene structure 21 in the dielectric layer 20, the damascene structure comprising a bottom surface and first and second sidewalls; a conductor 23a located in

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the damascene structure, the conductor comprising a conductive material, a liner layer 24 lining the bottom surface and the sidewalls of the damascene structure and contacting first, second and third surfaces of the conductor; wherein the liner material comprises titanium nitride with an amorphous character (Col. 8, l. 28-32), and a thickness of 700Å; further comprising a subliner 22 of titanium with a thickness of 300Å; and the conductive material of the conductor 23a is aluminum.

With respect to the limitation of a liner layer that imparts a random grain orientation in the conductive material of the conductor to improve electromigration lifetime of the conductor, Sumi teaches an amorphous liner layer and the conductor layer comprising an alloy of aluminum and silicon and it would have been obvious to one of ordinary skill in the art that aluminum alloys, such as Al-Si have a much better resistance to electromigration and this effect is enhanced when aluminum alloys formed on non-textured surfaces, such as the amorphous titanium nitride, tend to assume the underlying film texture, thus the layer is of amorphous character, and the structure will inherently possess the characteristic of improved electromigration lifetime.

With respect to claim 9, the limitation of "N₂/H₂ plasma treated titanium nitride" is directed to a process for forming an amorphous titanium nitride layer. "Product by process" limitations in claims drawn to structure are directed to the product, and not the process by which the product was obtained.

With respect to claims 8 and 15, since applicants failed to show a critical nature of the claimed thicknesses pertaining unexpected results, further noting that it is well

known and desirable in the art that to some extent scaling for higher density requires thinner device layers, it would have been obvious to one of ordinary skill in the art to vary the thicknesses of the titanium nitride layer and the aluminum layer.

Response to Arguments

6. Applicant's arguments filed 6/27/00 have been fully considered but they are not persuasive.

With respect to Applicant's argument that the conventional wisdom teaches away from the present invention and that one skilled in the art would specifically avoid forming a conductor with random grain orientation by lining sidewalls and bottom of a damascene structure with a liner having amorphous character, it is noted that Sumi teaches forming a conductor on a liner having amorphous character, and that it would be an inherent result that the conductor will be formed with random grain orientation due to the underlying amorphous layer and that inherently the electromigration lifetime will be improved.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ginette Peralta whose telephone number is (703)305-7722. The examiner can normally be reached on Monday to Friday 8:00 AM-4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703)306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703)308-7722 for regular communications and (703)308-7724 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

GP

November 15, 2000



OLIK CHAUDHURI
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800